

CRUISE RESULTS

Cruise 2002-01 *F/V Arcturus*
Cruise 2002-01 *F/V Aldebaran*

2002 Eastern Bering Sea Crab and Groundfish Survey

May-July 2002

The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) conducted the annual crab and groundfish bottom trawl survey of the eastern Bering Sea shelf from May to July 2002. This was a continuation of the annual series of eastern Bering Sea crab-groundfish assessment surveys which began in 1971.

OBJECTIVES

The primary objective of this survey was to continue the annual series of assessment surveys of crab and groundfish of the eastern Bering Sea to provide information for:

1. the North Pacific Fishery Management Council on the distribution, abundance, and biological condition of important groundfish and crab species;
2. the U.S. fishing industry on catch per unit effort and size composition, and;
3. the support of ongoing studies on the biology, behavior, and dynamics of key ecosystem components.

Secondary objectives were to:

1. conduct additional sampling in areas of high king crab and Tanner crab abundance to reduce variability in population estimates;

2. evaluate bottom trawl performance and configuration with net mensuration equipment;
3. sample near shore sites near Togiak Bay, Kuskowim Bay, and Port Moller to investigate distribution of yellowfin sole and other species in areas immediately adjacent to the standard survey area;
4. sample additional sites north and east of St. Matthew Island to collect information on snow crab;
5. collect and preserve specimens of fish and invertebrates for a voucher data base;
6. collect stomach samples for trophic interaction studies;
7. collect and preserve various whole specimens and tissue samples from both fish and invertebrates for special study requests;
8. collect and preserve live specimens of the tanner crab, *Chionocetes opilio*, for reproductive studies and;
9. collect data for estimating catchability of red king crab (*Paralithodes camtschaticus*).

VESSELS AND GEAR

Sampling at the standard sites was coordinated between two chartered commercial vessels, the *F/V Arcturus* and *F/V Aldebaran*. Both vessels were 39.6 m (130 ft) in length.

The bottom trawl used at all standard sampling stations was an 83-112 eastern trawl. These nets have a 25.3 m (83 ft) headrope and a 34.1 m (112 ft) footrope (Fig. 1). They were towed behind 1,000 kg, 1.8 X 2.7 m, steel V-doors and 54.9 m (180.1 ft) paired dandyline. Each lower dandyline had a 0.61 m chain extension connected to the lower wing edge to improve bottom tending characteristics. The 83-112 eastern trawl has been the standard sampling net used during annual eastern Bering Sea surveys since 1982 when it replaced the 400 mesh eastern trawl, previously used since the 1970s.

Seawater temperature profiles were collected at most sampling sites using a micro-bathythermograph attached to the headrope of

the net. Surface seawater temperatures were also collected with a bucket thermometer.

Net mensuration systems and bottom contact sensors aboard both vessels were used to provide sampling net configuration and performance data to be used in area-swept and catch-per-unit-effort (CPUE) calculations.

ITINERARY

The bottom trawl survey began in Dutch Harbor, Alaska on May 29. The *Aldebaran* and *Arcturus* completed the charter on August 1 in Dutch Harbor. Intervening port calls were made to Dutch Harbor on June 19 and July 10 to exchange scientific personnel.

Upon completion of the scheduled standard survey stations, the *Aldebaran* conducted a joint NMFS and Alaska Department of Fish and Game (ADF&G) study on the reproductive biology of the Tanner crab, *C. opilio*. Live specimens were collected from two geographical areas: the cold waters northwest of St. Matthew Island and the warmer waters just north of the Pribilof Islands. The samples were returned live to Dutch Harbor for further processing.

Upon completion of its portion of the survey, the *Arcturus* returned to Bristol Bay and conducted a special project to examine size and sex-dependent capture rates of red king crab and other species. An auxiliary net (underbag) was attached to the 83-112 sampling net to capture and assess the number of animals passing beneath the standard survey trawl's footrope.

SURVEY DESIGN AND METHODS

The standard survey area is shown in Figure 2. Sampling sites were established on the basis of a 20 x 20 nm grid pattern used during previous surveys, although more intensive sampling was carried out in the Pribilof Islands and St. Matthew Island regions to collect additional data on crab populations. Additional stations north of the standard survey area were established to estimate the abundance of Tanner crab (*C. opilio*) in that area.

The *Arcturus* and *Aldebaran* then sampled alternate north/south columns of stations proceeding from Bristol Bay westward to the shelf edge. Tows of 30 minutes in duration were made at most sampling sites. All catches were sorted to the lowest possible

taxon, weighed, and enumerated. Station data including time, position, trawl performance, distance fished as well as catch information was entered onto diskettes with shipboard computer systems. Age samples (by sex-centimeter category), size composition, and other biological data were collected from the major fish species encountered. Length-width measurements, shell condition, clutch size, and tissues and organs for various studies were collected from the major crab species. Special study collections were stored in appropriate fixatives or were frozen.

RESULTS

The *Arcturus* and *Aldebaran* conducted 403 bottom trawls during the standard survey including 393 successfully completed trawls at scheduled sampling sites and 10 unsuccessful hauls.

Biological data collected from fish species are summarized in Table 1. The two vessels recorded 166,613 length measurements from the major fish species and 6,585 age structures were collected and preserved. Individual length-weight data were also recorded during the otolith collection process. A total of 7,864 stomachs were preserved from various fish taxa for feeding habit analysis.

Whole specimens and tissue samples of various fish and invertebrate species were preserved for identification, training, and other purposes.

The total standard survey area encompassed approximately 463,400 km². Catch rates of important fish and crab species, by depth zone, are shown in Table 2.

Walleye pollock (*Theragra chalcogramma*) was the most abundant round-fish species and had an overall CPUE of 107.4 kg/ha trawled. They were encountered at nearly all sampling sites, with largest mean catches (146.3 kg/ha) observed in outer shelf waters at depths of 100-200 m (Fig. 3). Mean catches were much lower at depths less than 50 m (12.8 kg/ha).

Northern rock sole (*Lepidopsetta polyxystra*) and yellowfin sole (*Limanda aspera*) were the most abundant flatfish species, with overall CPUE values of 42.5 kg/ha and 42.1 kg/ha, respectively. Yellowfin sole were primarily restricted to the central and inner shelf waters, while rock sole were more broadly distributed with concentrations in Bristol Bay, around the Pribilof Islands, and the outer shelf (Figs. 4 and 5). Yellowfin sole catches decreased

sharply with increased depth, from 109.9 kg/ha in waters less than 50 m to less than 0.1 kg/ha in waters greater than 100 m (Table 2). A similar depth-related decrease in rock sole abundance was also observed.

Pacific cod (*Gadus macrocephalus*) were encountered at most of the sites sampled (Fig. 6). Mean catch rates were smallest at inner shelf stations less than 50 m (7.5 kg/ha) and greatest in the central shelf region (17.9 kg/ha).

Alaska plaice (*Pleuronectes quadrituberculatus*), flathead sole/Bering flounder (*Hippoglossoides elassodon* and *H. robustus*), arrowtooth/Kamchatka flounder (*Atherestes stomias* and *A. evermanni*), and Pacific halibut (*Hippoglossus stenolepis*) had a combined catch rate of 28.5 kg/ha. Alaska plaice and flathead sole/Bering flounder were the most abundant species of this group, with an overall catch rate of 9.0 kg/ha and 12.4 kg/ha respectively.

Snow crab (*C. opilio*) was the most abundant commercially important crab species encountered, with a total average catch rate of 2.6 kg/ha. Red king crab (*P. camtschatica*) had an overall mean CPUE of 1.6 kg/ha while blue king crab (*P. platypus*) and Bairdi Tanner crab had overall catch rates of 0.1 kg/ha and 0.9 kg/ha trawled respectively.

SCIENTIFIC PERSONNEL^a**Arcturus**Leg 1

F. Morado^b
 E. Acuna
 P. Von Szalay
 T. Buckley
 C. Armistead^d
 L. Byrne^e

Leg 2

P. Cummiskey^{bd}
 E. Acuna
 G. Lang
 S. Kotwiki
 V. Lowe
 K. Gravel^e

Leg 3

B. Otto^{bd}
 K. Weinberg
 C. Johnston
 K. Aydin
 F. Shaw
 D. Pengilly^e

AldebaranLeg 1

D. Nichol^b
 S. Kotwiki
 K. Redslob^c
 K. Swiney^d
 H. Lee
 P. Anderson^d

Leg 2

E. Munk^{bd}
 D. Benjamin
 G. Mundell
 M. Henderson
 K. Redslob^c
 J. Van Atta^d

Leg 3

T. Sample^b
 D. Benjamin
 K. Redslob^c
 M. Nelson
 R. MacIntosh^d
 L. Rugolo^d

^a Personnel from the AFSC, Seattle, unless otherwise noted

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^c Personnel from the International Pacific Halibut Commission

^d Personnel from the AFSC, Kodiak Laboratory

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Table 1.--Biological data collected during the 2002 eastern Bering Sea crab-groundfish survey.

Species	Length measurements	Age structures ^{1/}	Stomach samples
Walleye pollock	46,291	1,691	3,374
Pacific cod	12,238	959	2,303
Yellowfin sole	29,778	784	95
Northern Rock sole	29,075	533	75
Flathead sole/ Bering flounder ^{2/}	18,663	471	—
Pacific halibut	1,729	843	391
Alaska plaice	8,863	448	—
Arrowtooth flounder/ Kamchatka flounder	9,722	--	443
Greenland turbot	455	71	152
Rex sole	1,538	--	—
Longhead dab	1,697	227	—
Plain sculpin	1,691	345	—
Great sculpin	417	186	--
Bigmouth sculpin	120	27	
Starry flounder	772	--	—
Alaska skate	2,678	--	—
Bering skate	171	--	--
Pacific Ocean perch	217		
Misc. skates	22	--	614
Misc. species	476	—	417
Total	166,613	6,585	7,864

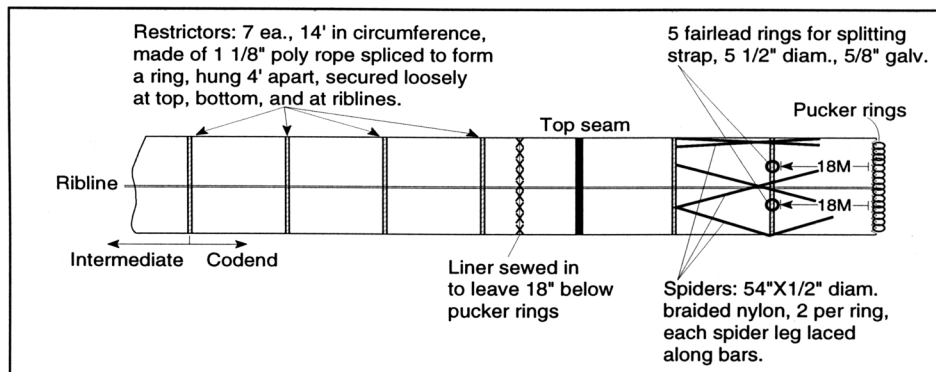
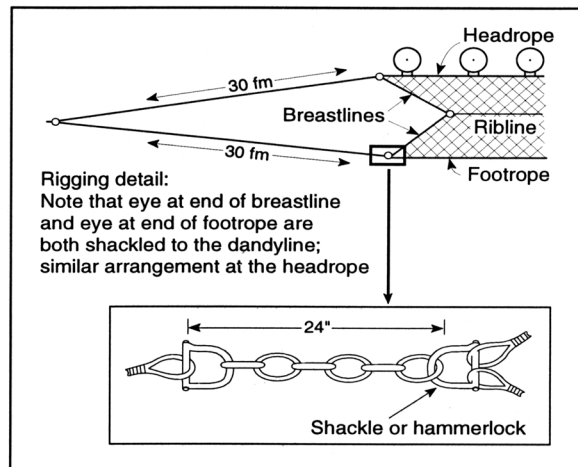
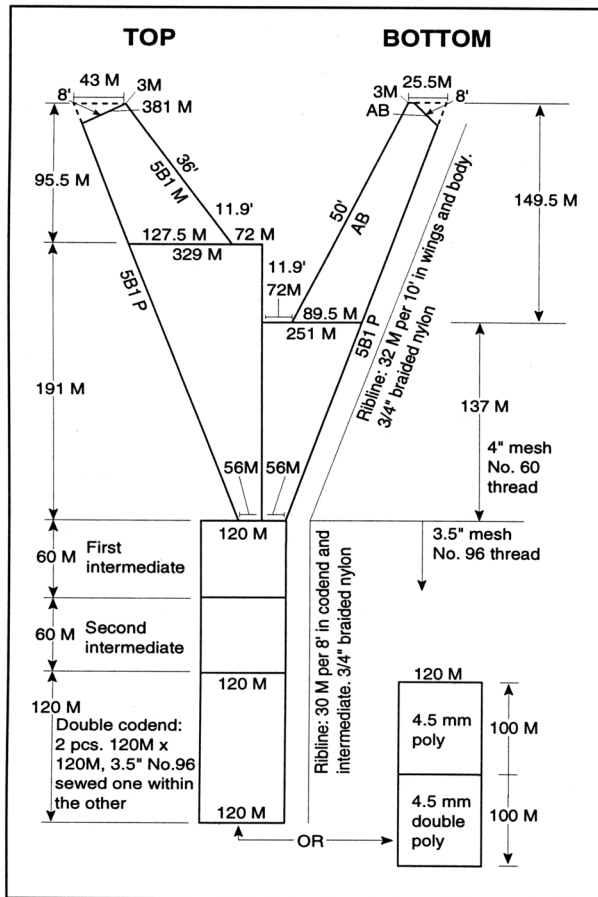
^{1/} Individual length-weight data were also collected.

^{2/} Age structures were collected from flathead sole only.

Table 2.--Catch rates (kg/ha) by depth zone of commercially important fish and crab species taken aboard the *Arcturus* and *Aldebaran* during the 2002 eastern Bering Sea crab-groundfish survey.

Species	Inner shelf < 50 m	Central shelf 50-100 m	Outer shelf 100-200 m	Total area
Walleye pollock	12.8	146.3	125.3	107.4
Yellowfin sole	109.9	29.7	<0.1	42.1
Rock sole	98.8	34.1	4.1	42.5
Pacific cod	7.5	17.9	12.0	13.8
Alaska plaice	10.0	12.3	1.8	9.0
Flathead sole/ Bering flounder	2.0	13.5	20.3	12.4
Arrowtooth flounder/ Kamchatka flounder	<0.1	5.0	18.0	7.1
Pacific halibut	3.0	1.6	2.4	2.1
Opilio Tanner crab	0.7	3.0	3.6	2.6
Red king crab	1.6	2.4	0.1	1.6
Bairdi Tanner crab	0.1	1.1	1.1	0.9
Blue king crab	0.0	0.3	<0.1	0.1

83/112 EASTERN



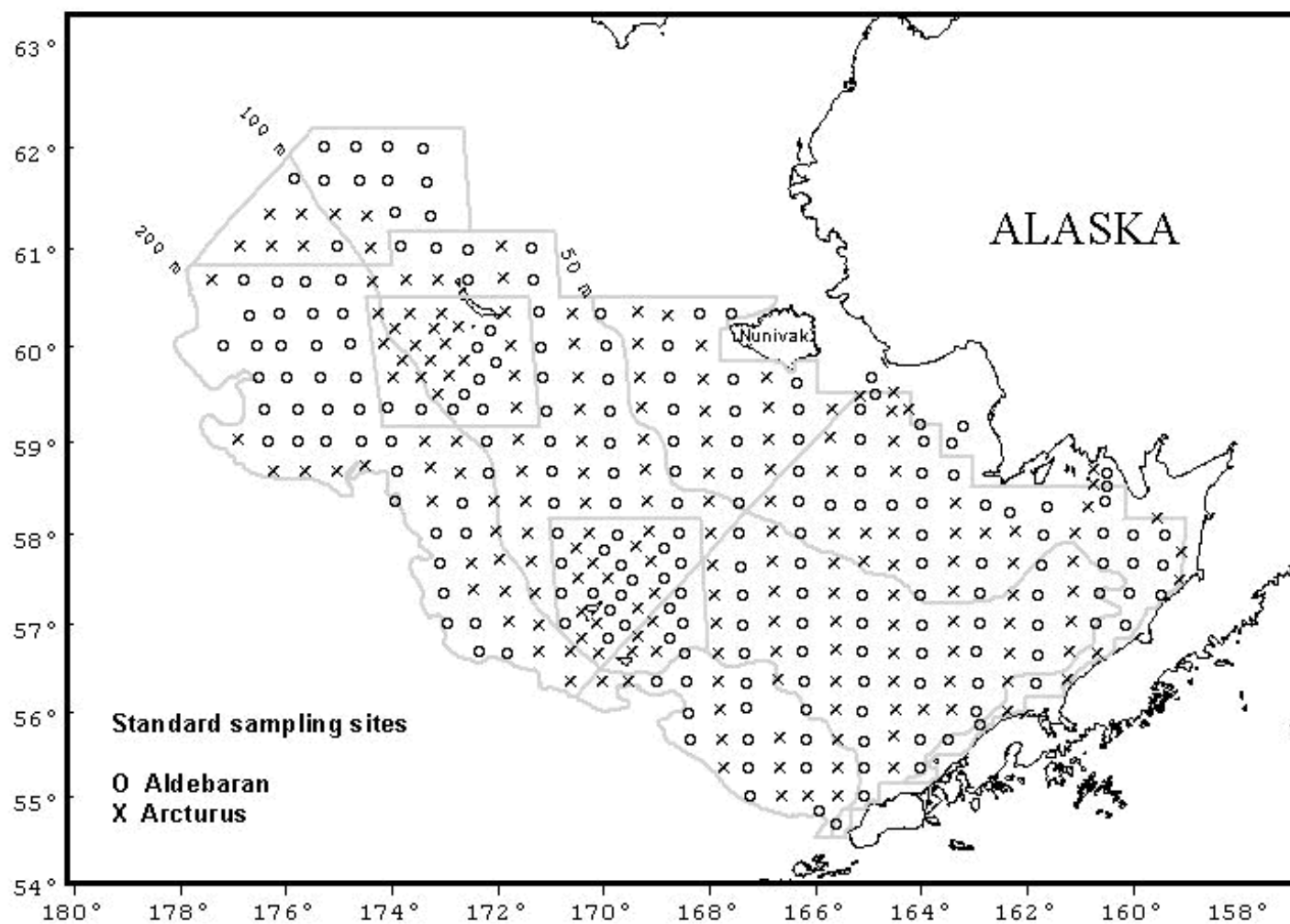


Figure 2. Distribution of total sampling effort by Aldebaran and Arcturus during the 2002 eastern Bering Sea bottom trawl survey.

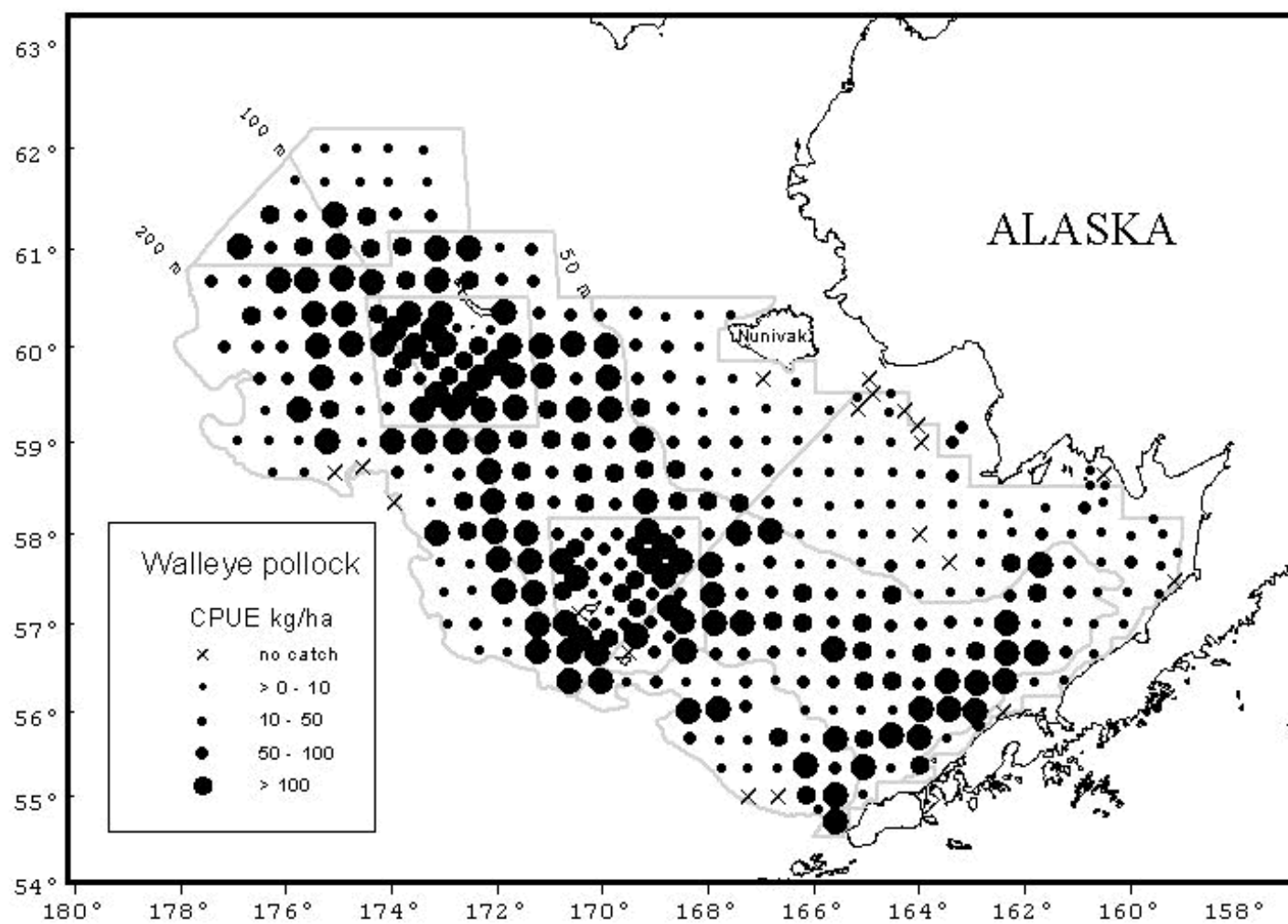


Figure 3. Distribution and relative abundance of walleye pollock during the 2002 eastern Bering Sea bottom trawl survey.

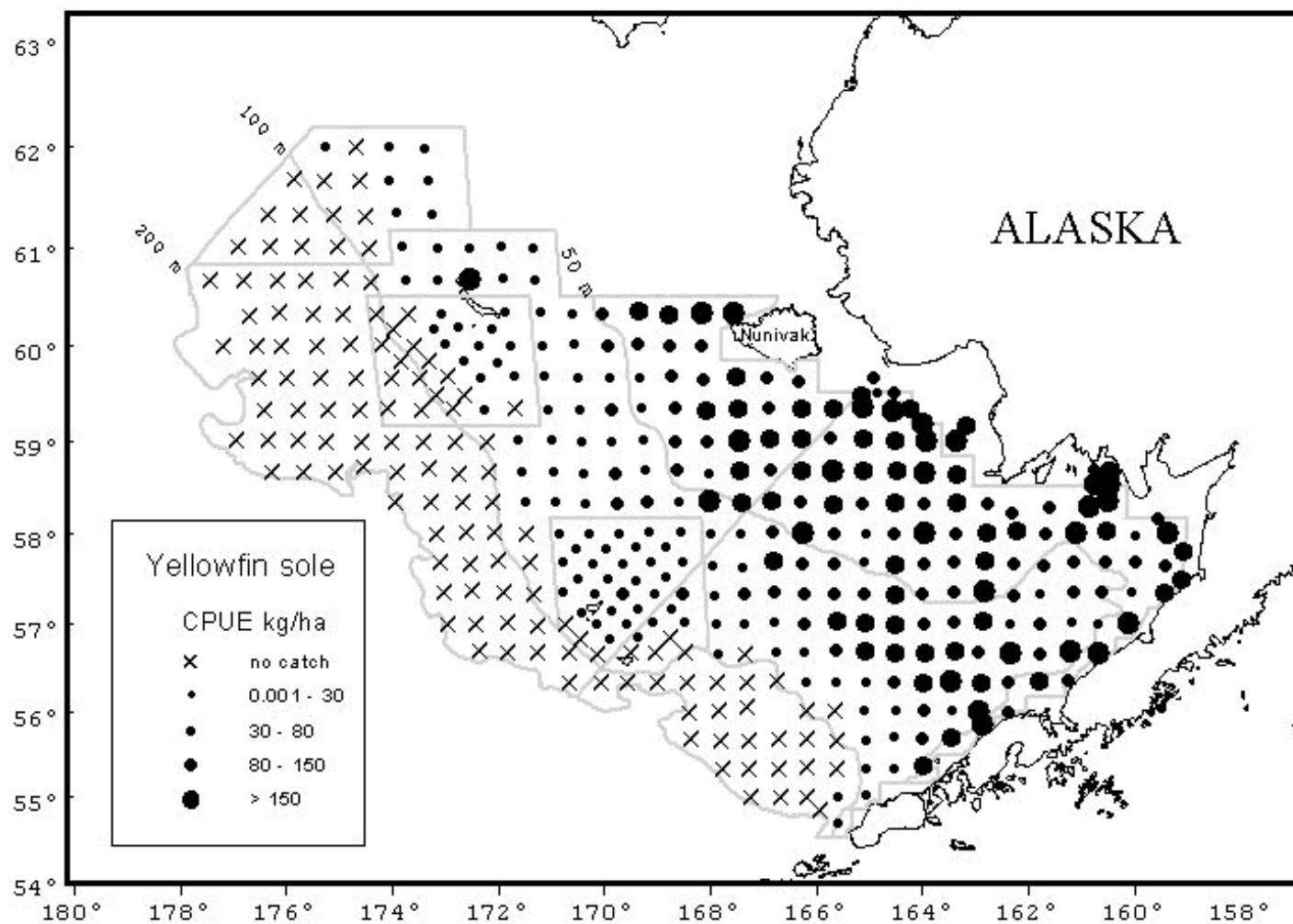


Figure 4. Distribution and relative abundance of yellowfin sole during the 2002 eastern Bering Sea bottom trawl survey.

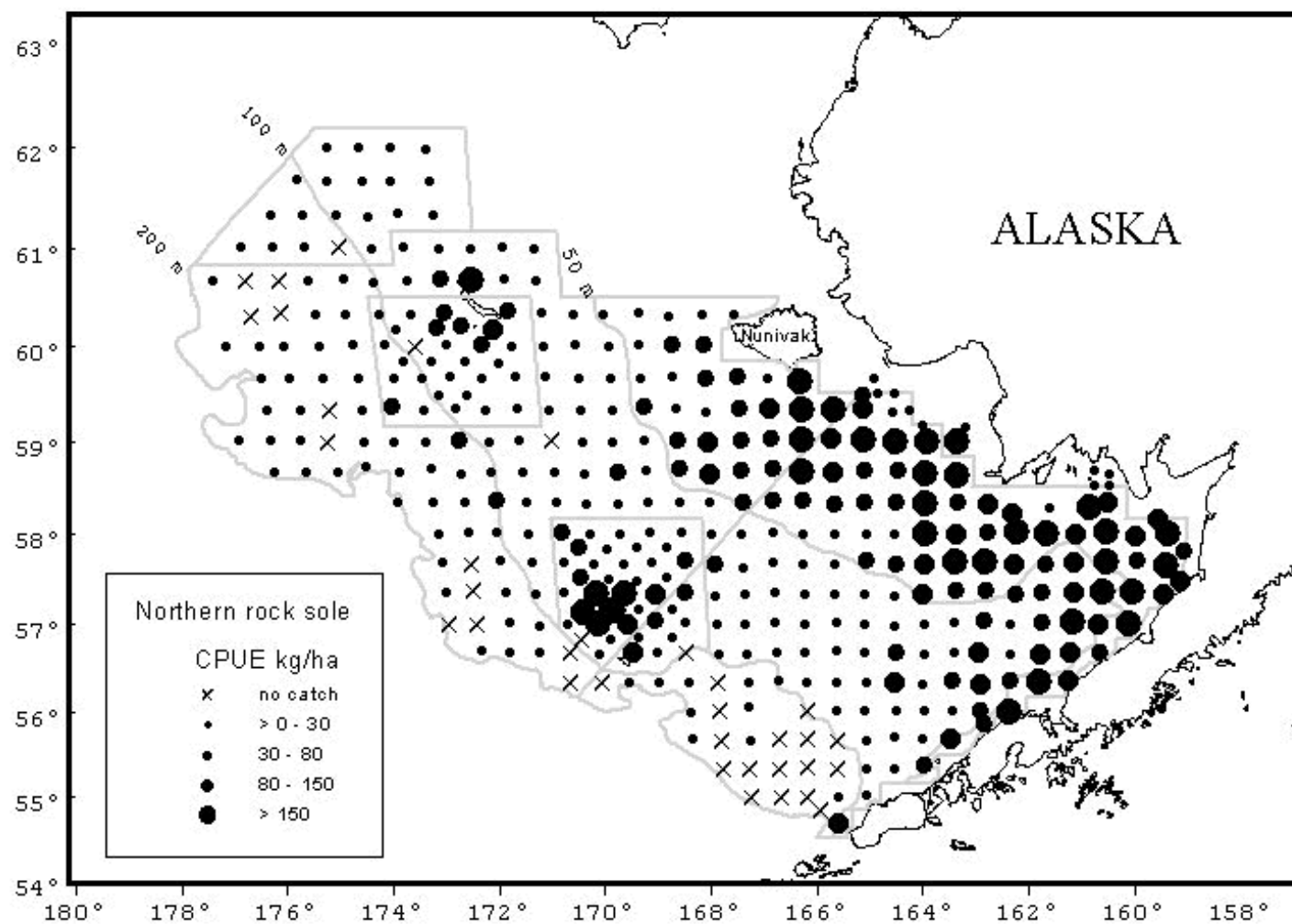


Figure 5. Distribution and relative abundance of Northern rock sole during the 2002 eastern Bering Sea bottom trawl survey.

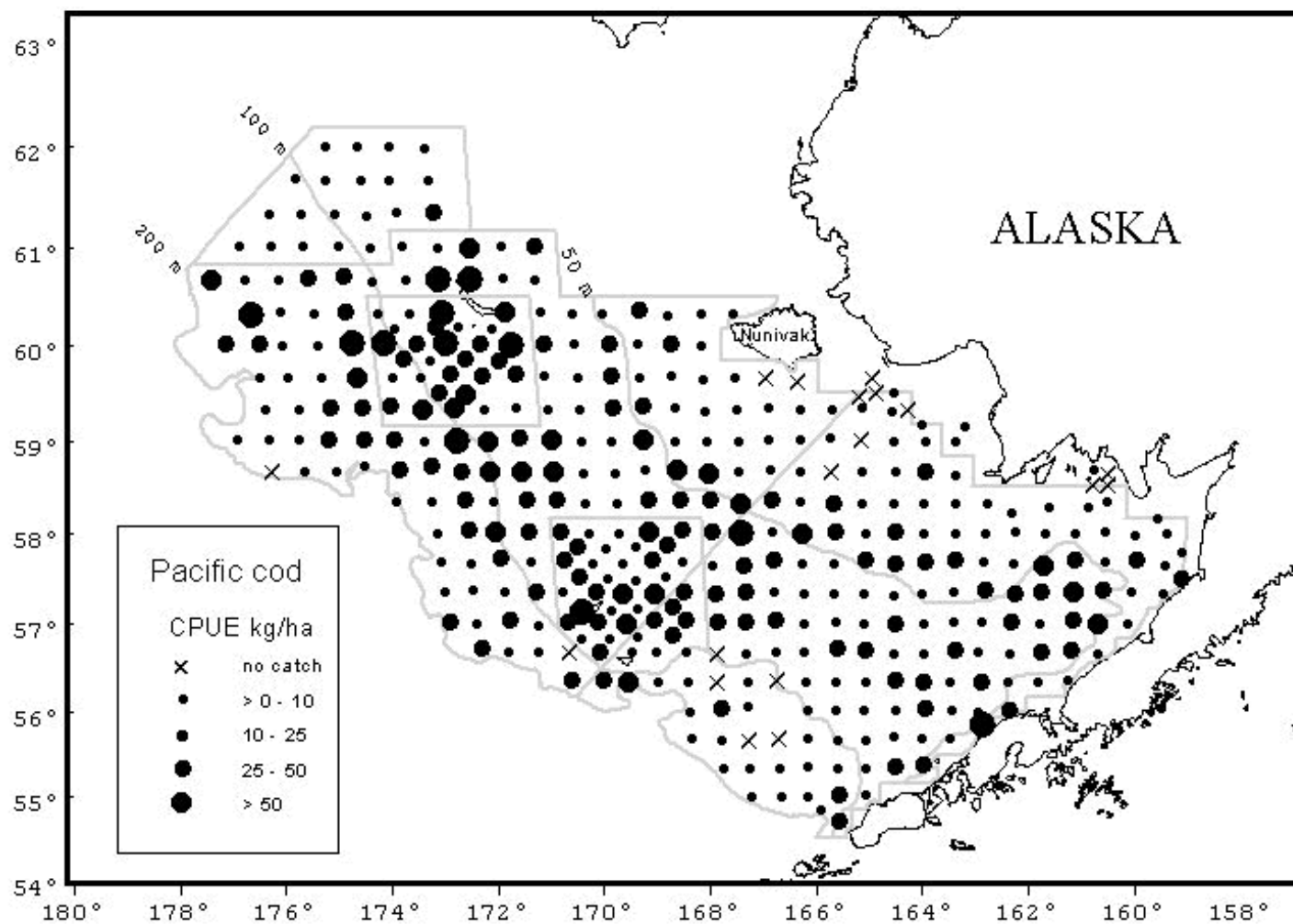


Figure 6. Distribution and relative abundance of Pacific cod during the 2002 eastern Bering Sea bottom trawl survey.